A new implementation of Dynamic TOPMODEL

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JBA trust

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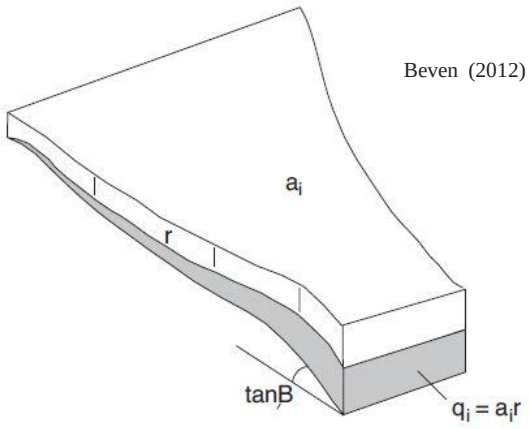
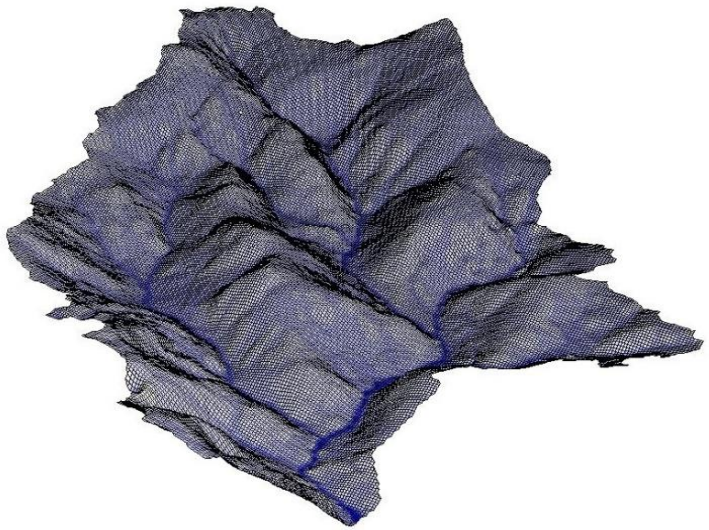
TOPMODEL (Beven and Kirkby 1979)

Key model assumption:

- Water table shape as if quasi-steady recharge for current local discharge allows prediction of saturated areas
- Exponential transmissivity profile leads to topographic index of hydrological similarity, as $\ln(a/\tan(\beta))$
- **Suitable only for frequently-wetted catchments with relatively thin soils and moderate slopes**



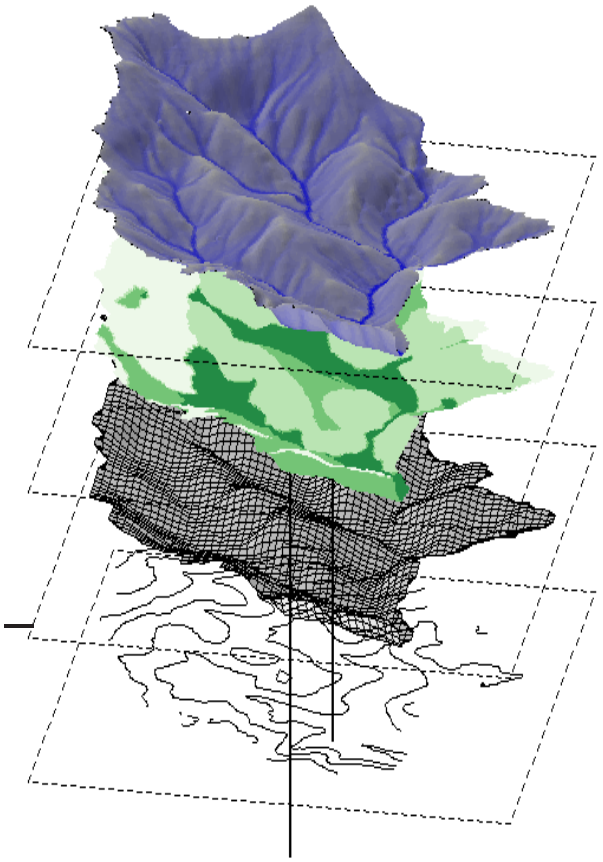
Beven (2012)



Digital River Network, and DEM: Brandt,, Robinson, Finch, (2004) , downloaded from CEH Information Gateway www.ceh.ac.uk)

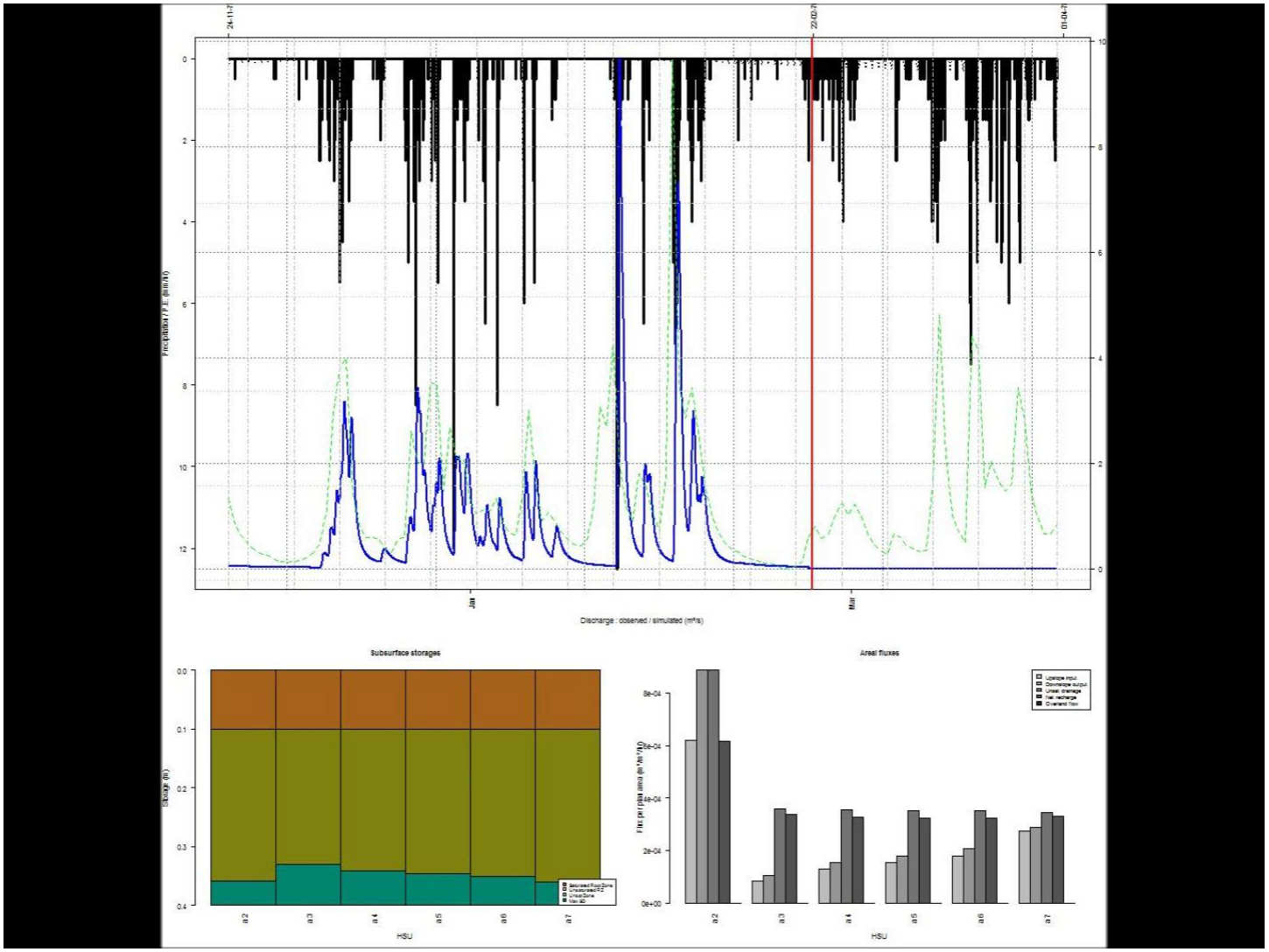
Dynamic TOPMODEL (Beven and Freer, 2001)

- **How does Dynamic TOPMODEL improve on the original TOPMODEL?**
- Extends concept of catchment discretisation
- Limiting storage deficit for downslope flow SD_{max}
- Simulates dried upslope areas and variable contributing areas
- Make use of overlays of contributing area, slope, soil type etc in defining response units – use to identify HSUs with catchment-specific features
- New open source coding in R



Metcalfe (2013), after Page, Beven et al (2007)

What have we done so far?



Wye calibration run
Area = 10.5 km²
Observed flows at Cefn Brwyn gauging station (crump weir)

Period: 1/10/77 – 1/4/78

7 HSU groups, discretised according to TWI plus channel network identified from DRN

SRZ_{max}, maximum root zone storage = 0.1 m

$\ln(T0)$, saturated transmissivity = 3 m²/hr

m, decline in transmissivity with depth to water table = 0.005m

SR_{init}, initial root zone storage = 0m

Td, vertical drainage time delay in unsat zone = 20 hr/m

S_{max}, max storage deficit = 3m

Thank you – questions?

References

Beven, K. J. and J. Freer (2001). "A Dynamic TOPMODEL." Hydrological Processes 15(10): 1993-2011.

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Brandt, C., Robinson, M. and Finch, J. (2004). Anatomy of a catchment: the relation of physical attributes of the Plynlimon catchments to variations in hydrology and water status. Hydrol. Earth Syst. Sci., 8, 345-354

Centre for Ecology and Hydrology Information Gateway. Plynlimon DEM and . Downloaded 5/2012 from https://gateway.ceh.ac.uk/

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